

The seal of the State of South Dakota is a circular emblem. It features a central landscape with a river, mountains, and a sun. The words "STATE OF SOUTH DAKOTA" are written in a circle around the top, and "GREAT SEAL" around the bottom. The year "1889" is at the bottom. A banner across the middle reads "UNDER THE PROTECTION OF THE GREAT SEAL".

# **STATEMENT OF BASIS**

## **Minor Air Quality Permit Review**

**Barnes Hay & Feed Co.**

**Gayville, South Dakota**

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## **1.0 BACKGROUND**

On February 23, 1998, Barnes Hay and Feed in Gayville, South Dakota, was issued a minor air quality operating permit (#28.0523-07) for the operation of an alfalfa pelletizing plant. Barnes Hay and Feed's initial operating permit expired on February 23, 2003.

On September 23, 2002, the department received Barnes Hay and Feed's application to renew its air quality permit. The permit was reviewed and issued October 27, 2004 and expired on October 27, 2009.

On September 14, 2009 Barnes Hay & Feed submitted an application for renewal. The renewal application is considered timely and the department has allowed Barnes Hay and Feed to operate under the expired permit until the department takes action on the permit renewal application.

Based on the renewal application there have been no changes to the permitted equipment operated by Barnes Hay and Feed. There have been no complaints or violations against this facility since the last permit review.

## **2.0 OPERATIONAL DESCRIPTION**

Dehydrated alfalfa is a meal product resulting from the rapid drying of alfalfa by artificial means. Alfalfa meal is processed into pellets for use in chicken rations, cattle feed, hog rations, sheep feed, turkey mash, and other formula feeds. The following equipment is used for alfalfa processing at this facility:

- Unit #1** 1974 Champion shredder and grinder used to grind alfalfa. The grinder has a maximum design operating rate of 5 tons per hour. A Champion cyclone is used to collect product;
- Unit #2** 1974 MEC alfalfa rotary dryer, model #SD85-25, fired with natural gas. The dryer has a heat input capacity of 13.3 million Btus per hour (MMBtus/hr) and can process 5 tons of alfalfa per hour. A Champion cyclone is used to collect product;
- Unit #3** 1968 Champion Grinder, model #20X44A, used to grind alfalfa. The grinder has a maximum design operating rate of 5 tons per hour. A Champion cyclone is used to collect product and particulate emissions are controlled by a baghouse;
- Unit #4** 1968 Sprout Waldron pellet cooler, model #21V200, used to cool alfalfa pellets. The cooler has a maximum design operating rate of 5 tons per hour. Particulate emissions are controlled by a Champion cyclone.

Barnes Hay and Feed also operates a Cleaver Brooks steam boiler, model CBH 263-70, with a maximum heat input capacity of 2.9 MMBtus/hr. In accordance with ARSD 74:36:04:03(5), a unit with a heat input capacity less than 3.5 MMBtus/hr is exempt from permitting. The boiler is considered an insignificant activity based on its heat input capacity.

### 3.0 EMISSION FACTORS

#### 3.1 Process units

Total suspended particulate (TSP) and particulate less than or equal to 10 microns in diameter (PM10) are the primary pollutants emitted from alfalfa pelletizing plants, although some odors may arise from the organic volatiles driven off during drying and pellet formation. Appendix A displays a flow sheet for an alfalfa dehydrating and palletizing plant which illustrates the emission points. The cyclones for Units #1, #2, and #3 are used to collect and move product to the next process. Therefore, potential uncontrolled emissions from these three units include the use of the cyclone because it would not be feasible to operate these units without the cyclones.

The emission factors for the dryer shown in Table 3-1 is derived from AP-42, Table 9.9.4-1, September 1996 (single-pass dryer cyclone). The addition of both the filterable and condensable particulate matter is used for the total suspended particulate matter in pounds per ton of pellet produced. The emission factor for the remaining equipment shown in Table 3-1 is derived from AP-42, Table 6.1-1, April 1976 where the grinder and shredder operations are categorized as a meal collector cyclone. The emission factors in AP-42 are based on the amount of product produced. In Table 3-1, the emissions factors were converted from product produced to the amount of alfalfa processed by dividing the emission factor by four as referenced in AP-42, Table 6.1-1, April 1976.

**Table 3-1 – Alfalfa Plant Process Emission Factors**

Equipment	<i>[pound per ton alfalfa processed]</i>	
	TSP	PM10 <sup>1</sup>
Grinder and Shredder	0.65	0.59
Dryer	1.19	1.07
Grinder	0.65	0.59
Pellet cooler	0.75	0.68

<sup>1</sup> – Based on Appendix B-1 of AP-42, 90 percent of the particulate emitted is assumed to be less than 10 microns in diameter.

#### 3.2 Dryer

The dryer burns natural gas as a fuel. The combustion of natural gas will result in criteria pollutant emissions. The quantity of emissions will depend on the combustion efficiency of the unit. AP-42 does not have a listing for the combustion emissions of alfalfa dryers. It will be assumed that the combustion efficiency of the dryer is the same as the combustion efficiency of a steam boiler of the same heat input capacity and the emission factors listed for boilers of this size will be used to estimate the dryer combustion emissions except for particulate since the particulate emission factor for the dryer includes the combustion of natural gas.

Direct fired grain drying operations and product dryers in grain processing plants may emit small quantities of volatile organic compounds (VOCs) and other combustion products; however no data are currently available to quantify the emission of these pollutants. Therefore, the emissions factors for boilers with a similar heat input and fuel source will be used for dryers. Table 3-2 displays the emission factors as derived from the Compilation of Air Pollutant Emission Factors (AP-42, Fifth Edition, Volume 1, Chapter 1, 1.4 (Natural Gas)).

**Table 3-2 – Fuel Emissions Factor for Dryers & Boilers**

<b>Fuel Type</b>	<b>Pollutant</b>					
	<b>TSP/PM<sub>10</sub></b>	<b>SO<sub>2</sub><sup>1</sup></b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>HAPs</b>
Natural Gas (lbs/MMcf) <sup>2</sup>	7.6	0.6	100	81	5.5	1.8

<sup>1</sup> – For propane, “S” equals the sulfur content expressed in grains per 100 cubic feet gas vapor. The average sulfur content of propane is estimated to be similar to the sulfur content of natural gas and butane gas. Natural gas has an average sulfur content of 0.2 grains per 100 cubic feet and butane has an average sulfur content of 0.18 grains per 100 cubic feet. The higher value will be used in determination of the emission factors. For oil, “S” indicates the weight % of sulfur. For example, if the fuel contains 1% sulfur, then S = 1;

<sup>2</sup> – To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,000 Btus/cf; and

## 4.0 POTENTIAL EMISSIONS

### 4.1 Process Units

Potential emissions of each pollutant are calculated from the maximum design capacity for the units as listed in the application, the pollutant emission factor, and assuming the unit operates every hour of every day of the year (8,760 hours per year).

Equation 4-1 was used to estimate the potential emissions from the units.

#### **Equation 4-1 –Potential Process Emissions**

$$Potential \left[ \frac{\text{tons}}{\text{yr}} \right] = design\ capacity \left[ \frac{\text{tons alfalfa}}{\text{hr}} \right] \times emission\ factor \left[ \frac{\text{lbs}}{\text{ton alfalfa}} \right] \times 8760 \left[ \frac{\text{hrs}}{\text{yr}} \right] \div 2000 \left[ \frac{\text{lbs}}{\text{ton}} \right]$$

The resulting potential emissions for each process unit can be seen in Table 4-1 below.

### 4.2 Dryer

The heat input capacity of the dryer is not listed in the current renewal application. In the previous renewal application the dryers maximum design heat input capacity is listed as 13.3 MMBtu/hr. Equation 4-2 was used to estimate the potential emissions from the dryer based on the boiler emission factors, the heat input capacity, and a natural gas heat content of 1000 MMBtu per MMcf.

#### ***Equation 4-2 –Potential Dryer Emissions***

$$Potential \left[ \frac{\text{tons}}{\text{yr}} \right] = \text{input capacity} \left[ \frac{\text{MMBtu}}{\text{hr}} \right] \times E.F. \left[ \frac{\text{lbs}}{\text{MMBtu}} \right] \times 8760 \left[ \frac{\text{hrs}}{\text{yr}} \right] \div 2000 \left[ \frac{\text{lbs}}{\text{ton}} \right]$$

The resulting potential emissions of each pollutant from the dryer can be seen in Table 4-1 below.

Table 4-1 below summarizes the annual emissions from the various emission points and shows the total potential annual emissions for the facility.

***Table 4-1 – Potential Emissions Summary in Tons of Pollutant Per Year***

<b><i>Process Unit</i></b>	<b>TSP</b>	<b>PM10</b>	<b>SOx</b>	<b>NOx</b>	<b>CO</b>	<b>VOC</b>	<b>HAPs</b>
Grinder & Shredder	14.2	12.9	-	-	-	-	-
Dryer	26.5	23.9	0.03	5.7	4.8	0.3	0.1
Grinder	14.2	12.9	-	-	-	-	-
Pellet Cooler	16.4	14.9	-	-	-	-	-
<b>Total</b>	<b>71</b>	<b>65</b>	<b>0</b>	<b>6</b>	<b>5</b>	<b>0</b>	<b>0</b>

## **5.0 PERMIT REQUIREMENTS**

### **5.1 New Source Review**

ARSD 74:36:10:01 states that New Source Review (NSR) regulations apply to areas of the state which are designated as non-attainment for any pollutant regulated under the Clean Air Act. The facility is located in Gayville, South Dakota, which is in attainment for all the pollutants regulated under the Clean Air Act. Therefore, Barnes Hay and Feed is not subject to NSR review.

### **5.2 Prevention of Significant Deterioration**

In accordance with ARSD 74:36:09, as referenced to 40 CFR § 52.21(b)(1), any stationary source which emits or has the potential to emit 250 tons per year or more of any air pollutant is subject to PSD requirements. In accordance with ARSD 74:36:09, as referenced to 40 CFR § 52.21(b)(1), any stationary source which emits or has the potential to emit 100 tons per year or more of any air pollutant and is subject to one of the 28 named PSD source categories is subject to PSD requirements. The “potential to emit” as defined in the PSD rules is the maximum capacity of a stationary source under its physical and operational design. Any physical or operation limitation on the equipment, provided the limitation is enforceable, shall be treated as part of its design.

Barnes Hay and Feed is not one of the 28 named PSD source categories and does not meet the 250 tons per year threshold. Therefore, Barnes Hay and Feed is considered a minor source under the PSD program and is not subject to PSD requirements.

### **5.3 New Source Performance Standards (NSPS)**

ARSD 74:36:07:05 - 40 C.F.R., Part 60.40c, Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units. The provisions of this subpart are applicable to each boiler that has a minimum design heat input capacity equal to or greater than 10 MM Btu per hour but less than or equal to 100 MMBtu per hour; and commences construction or modification after June 9, 1989. The boiler at Barnes Hay and Feed is exempt from permitting and this performance standard based on its designed heat input capacity.

### **5.4 National Emission Standards for Hazardous Air Pollutants (NESHAP)**

ARSD 74:36:08 - 40 C.F.R., Part 61, National Emission Standards for Hazardous Air Pollutants. Presently, there are no finalized or promulgated National Emissions Standards for Hazardous Air Pollutants for the type of operations used by Barnes Hay and Feed.

### **5.5 Minor Air Quality Operating Permit**

Based on the above findings Barnes Hay and Feed is classified as a minor source for particulate emissions under the air quality operating permit program. Barnes Hay and Feed is applying for renewal of a minor air quality operating permit. A minor source is defined as any source with the potential to emit greater than 25 tons per year but less than 100 tons per year of a criteria pollutant. A source operating in South Dakota that meets the definition of a minor source is required to obtain a minor air quality operating permit under the Administrative Rules of South Dakota (ARSD) 74:36:04.

### **5.6 Particulate Limits**

State particulate emission limits for process units are derived from ARSD 74:36:06:03. Equation 5-1, taken from ARSD 74:36:06:03(1)(a), is used to calculate the state limit of particulate emissions for each process unit because the units have a maximum process rate less than 60,000 pounds per hour (30 tons per hour).

***Equation 5-1 – State Particulate Emission Limit for Process Units < 30 tons per hour***

$$E_{TSP} \frac{lbs}{hour} = 4.10 \times P^{0.67} \quad (\text{Where } P \text{ is the design process rate in units of tons per hour})$$

Because the units in question have identical maximum design process flow rates, they have the same state particulate emission limit. The calculated particulate emission limits for the process units are 12.1 pounds per hour per unit

Equation 5-2 was used to estimate the potential emissions from the units based on the listed emission factor and the processing capacity of the unit.

**Equation 5-2 –Potential Process Emissions**

$$Potential \left[ \frac{lbs}{hr} \right] = design\ capacity \left[ \frac{tons\ alfalfa}{hr} \right] \times emission\ factor \left[ \frac{lbs}{ton\ alfalfa} \right]$$

Based on the emission factors and Equation 5-2, the potential emission rates of the process units are shown below in Table 5-1.

**Table 5-1 – Potential Process Emissions in Pound per Hour**

Process Unit	[lbs per hour]
	<b>TSP</b>
<b>Grinder &amp; Shredder</b>	3.2
<b>Dryer</b>	6.0
<b>Grinder</b>	3.3
<b>Pellet Cooler</b>	3.8

Based on the above calculations the process units are capable are operating within the state particulate limits.

## 5.7 Sulfur Dioxide Limit

In accordance with ARSD 74:36:06:03(2) the sulfur dioxide emission limit is three pounds per MMBtu of heat input to a fuel burning unit. The sulfur dioxide emission factor for the dryer is listed in units of pounds per MMcf of gas burned. Equation 5-4 shows the conversion of the emission factor to units of pounds per MMBtu based on a natural gas heat content of 1000 MMBtu per MMcf.

**Equation 5-4 – Potential TSP and SO<sub>2</sub> Emissions – Dryer**

$$P_{SO_2} \frac{lbs}{MMBtu} = emission\ factor \frac{lbs}{MMcf} \div heat\ content \frac{MMBtus}{MMcf}$$

$$P_{SO_2} \frac{lbs}{MMBtu} = 0.6 \frac{lbs}{MMcf} \div 1,000 \frac{MMBtus}{MMcf} = 0.001 \frac{lbs}{MMBtus}$$

Based on the above comparisons and the facility's compliance history, Barnes Hay and Feed is capable of operating in compliance with the state air emission limits.

## **5.8 Opacity Limit**

In accordance with ARSD 74:36:12:03, an owner or operator of a facility that pelletizers or dehydrates alfalfa, or that does both, may discharge in the ambient air an air pollutant of a density no greater than 30 percent opacity.

## **6.0 SUMMARY OF APPLICABLE STATE REQUIREMENTS**

Barnes Hay and Feed's potential emissions of TSP are less than 100 tons per year. Therefore Barnes Hay and Feed will be required to obtain a minor air quality operating permit and operate within the requirements stipulated in the following regulations:

- ARSD 74:36:04 - Operating Permits for Minor Sources
- ARSD 74:36:06 - Regulated Air Pollutant Emissions
- ARSD 74:36:11 - Stack Performance Testing
- ARSD 74:36:12 - Control of Visible Emissions

## **7.0 RECOMMENDATION**

Based on the information submitted in the air quality permit renewal application and this review, the department recommends the approval of a minor air quality operating permit for Barnes Hay and Feed in Gayville, South Dakota.

Questions regarding this permit review should be directed to Lisa Robinson, Natural Resources Engineer, Air Quality Program.

## **APPENDIX A**

### **PROCESS FLOW SHEET FOR TYPICAL ALFALFA DEHYDRATING/PELLET PLANT**

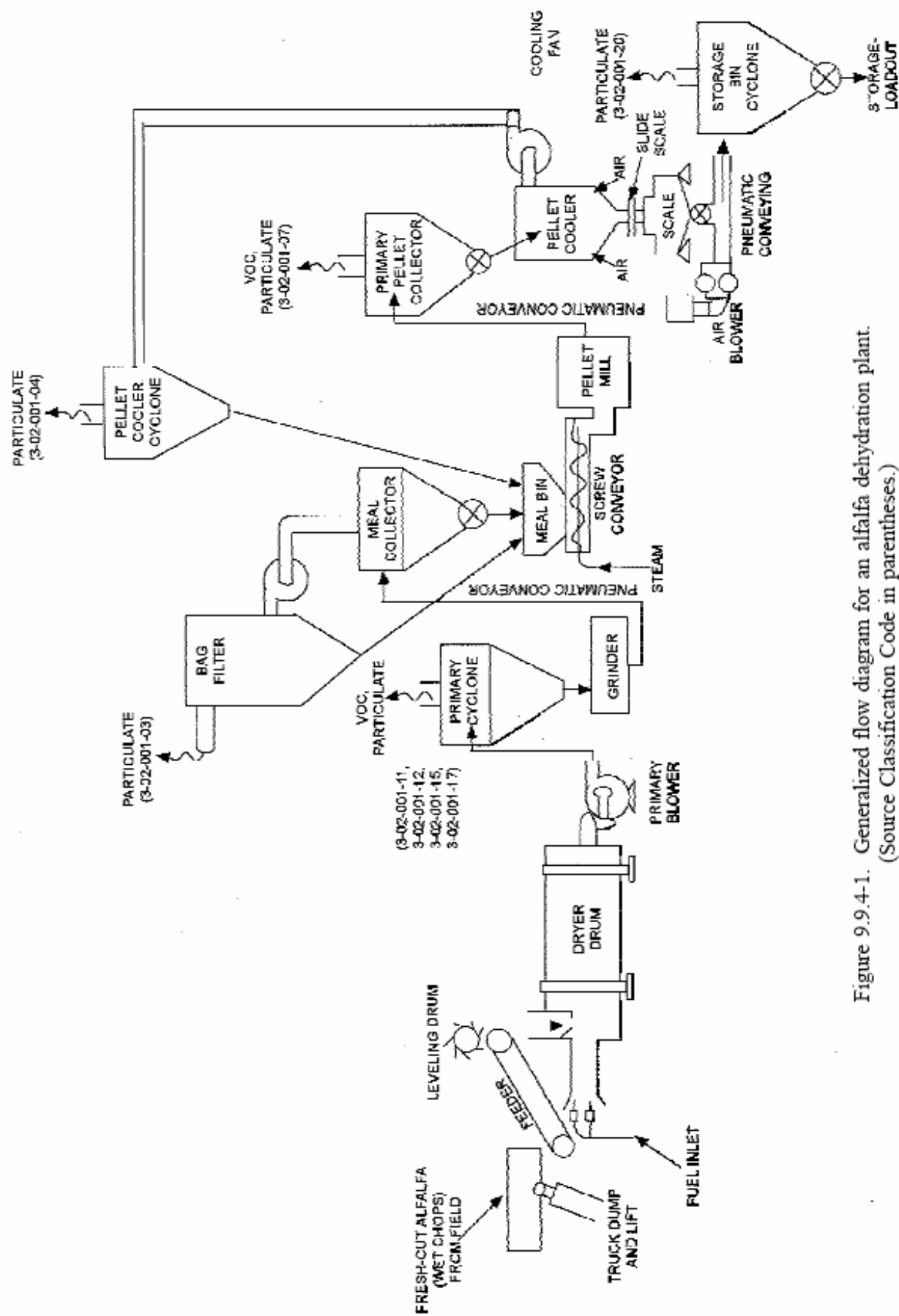


Figure 9.9.4-1. Generalized flow diagram for an alfalfa dehydration plant.  
(Source Classification Code in parentheses.)